

# **Liquefied Gas**

## **Mariner Training Standards**

LG Training Standards  
Technical Working Group

**5 June 2007**

# **Liquefied Gas Mariner Training Standards**

## **Introduction**

We, the LG Mariner Training Standards Technical Working Group (TWG) have composed three tables of training standards that address the increased level of awareness, knowledge and understanding required of the specific cargo handling principles aboard liquid gas tankers. Our group consisted of representatives from all United States, State/Federal Maritime Academies and Industry Schools, facilitated by the Maritime Administration. The group was particularly interested in establishing the training standards specifically for the LNG sector. Based on precedent of the STCW, the documents as generated are intended to be inclusive of the liquid gas (LG) trades as a whole.

Our intentions were multifold:

1. The TWG needed to essentially establish a foundation level of training that all major U.S. training institutions would agree to for LG training at various levels.
2. The TWG chose to look at this as an opportunity to examine the current STCW requirements for LG training in light of the comprehensive review that has begun.
3. The TWG looked to the industry bodies and classification societies for recommendations, industry practices and concerns regarding the current level of LG training.
4. The end result became three training documents, AWARENESS, SPECIFIC DUTIES and PERSON-IN-CHARGE.

## **Format**

The format for the training standards document was created to be consistent with the established formatting of the tables of the STCW. As of now, the STCW dangerous cargo training programs have not been expanded into the accepted tabular four columns format used elsewhere in the STCW.

Column 1 – COMPETENCE.

This column states the general aptitude required as it relates to the section's title.

Column 2 – KNOWLEDGE, UNDERSTANDING AND PROFICIENCY (KUP).

This column states the specific minimum objectives under each section.

Column 3 – METHODS FOR DETERMINING COMPETENCE. This column states the manner in which column 2 may be determined.

Column 4 – CRITERIA FOR EVALUATING COMPETENCE.

This column states the outcomes expected of the student.

### **Additional Columns**

This document contains only the four columns as previously described. A document has been provided to the schools for developing curriculum and includes two additional columns. In the Specific Duties and PIC LG training standards documents columns 5 and 6 reference the corresponding *SIGTTO LNG Training Project, Appendix of Underpinning Knowledge (2005)*. These two columns are added only to demonstrate how educational institutions may use the LG training standards documents seamlessly with current industry training regimes. This will be particularly useful if schools choose to acquire third party accreditation in compliance with the SIGTTO (Society of International Gas Tankers and Terminal Operators) LNG Training Project.

Column 5 – SIGTTO Codes

Column 6 – SIGTTO KUP titles

### **Taxonomy**

The taxonomy used within the tables follows along established lines. Specific guidance on this issue was taken from the established STCW methodology and from the test requirements used by DNV in their SEASKILLS program (*Competence of Shipboard LNG Cargo Operations, March 2006*) which references Bloom, *et. al.* (1956).

Where column 2 states the required skill and level, column 4 uses a corresponding behavioral verb to demonstrate the objectives of column 2.

### **Practical Assessments**

The TWG agreed to develop this curriculum around LNG simulators for learning and assessment. Further, the TWG recommends implementing competence assessment using LNG simulators as soon as possible, but no later than the anticipated IMO mandatory date of 2012. Many of the TWG members have already incorporated simulators into their courses, with others committed to follow suit.

### **Sections**

The numerically titled sections are based on the STCW section titles outlined in STCW Chapter V Section A-V/1. The parenthetical numbers correspond to regulations in STCW Chapter V Section A-V/1, where applicable, and are meant for reference only.

## **Documents**

The documents represent training standards for three distinct levels.

### **AWARENESS**

The AWARENESS document is designed to address a basic fundamental need for all personnel onboard LNG vessels. The TWG recommends all mariners possess a minimum awareness of the safety and environmental concerns associated with the cargo and its safe carriage. Specific attention to safety and general awareness should be held amongst all of the crew. Crew sizes being what they are in this modern age, all hands have an increased responsibility for safety of life and the environment.

### **SPECIFIC DUTIES**

The SPECIFIC DUTIES document was previously called FAMILIARIZATION training under the current STCW. These standards of training are intended for all ratings having cargo related duties that are operational in task and responsibility, but do not include senior management tasks of maintaining command and control of the cargo operations. These mariners continue to work under the direct authority of the Person In Charge. Comparisons to the SIGTTO competencies required for Junior Officers (Deck and Engine) who may participate in cargo and cargo related operations were given special concern and consideration.

### **PERSON IN CHARGE**

The PERSON IN CHARGE document was previously called SPECIALIZATION training under the current STCW. These standards of training are intended for those persons exercising authoritative control over the LNG cargo operations. Consideration was taken looking at the Industry's concerns for the level of training required for these PIC ratings namely, the Chief Officer and Cargo Engineer. Comparisons to the SIGTTO competencies required for these ratings, and other persons who may participate in cargo related operations at this level, were closely examined with special concern and consideration.

## **Conclusion**

The STCW and SIGTTO documents demonstrate the variance in the approach between the IMO and that of the industry. The STCW clearly emphasizes the safety of life and of the environment. The methodology of the industry emphasizes operational competence. The overriding objectives are the same, to see this sector's impeccable safety record continue.

The LG training standards documents demonstrate the need and urgency to have consensus on LNG training. The LNG industry, and all of the maritime sectors that support the safe transportation of LNG, through education, training, assessment and verification of knowledge and skills, will carry this tradition forward. The success of the past cannot carry on without continual self-examination and improvements in training. The TWG believes all parties involved are so committed.

# **Liquefied Gas Mariner Training Standards**

## **LG STANDARDS FOR ENTRY PERSONNEL**

### **LIQUEFIED GAS (LG) AWARENESS TRAINING PROGRAM**

**Mandatory minimum requirements for the training and qualifications of Entry and Culinary (CADETS, OS, WIPER, SA, COOKS and STEWARDS) seafarers on LG tankers.**

Mandatory minimum requirements for the training and qualification of **Entry and Culinary (CADETS, OS, WIPER, SA, COOKS and STEWARDS)** seafarers on LG tankers.

1. Entry and Culinary seafarers assigned aboard LG tankers shall have completed Basic Safety Training required by regulation VI/1 and shall have completed:
  - .1 an approved LG tanker AWARENESS course addressing the standards of competence outlined here, for responsibilities and safety of non-watch standing personnel aboard LG Tankers

Column 1	Column 2	Column 3	Column 4
<b>AWARENESS</b>			
Competence	Knowledge, understanding, and proficiency	Methods for determining competence	Criteria for evaluating competence
	<b><i>Nomenclature of LG cargoes and Ship Terminology</i></b>		
Carriage of LG cargoes.	<b>1.</b> Have awareness of the terminology related to LG tankers  Have awareness of the various types of LG tankers	Examination and assessment of evidence obtained from one or more of the following:  1. Approved in-service LG experience. 2. Approved LG Awareness Course	Aware of the terms associated with LG cargoes and vessels.  Aware of the different types of LG tankers
	<b><i>Personal Hazards and Toxicity of LG and Relevant Gases</i></b>		
Carriage of LG cargoes.	<b>2.</b> Aware of the hazards of LG :  .1 toxicity .2 the dangers to personnel covering hazards of skin contact, inhalation and ingestion; .3 flammability hazards, flammability limits and sources of ignition; .4 environmental hazards; .5 cryogenic hazards .6 confined or enclosed spaces	Examination and assessment of evidence obtained from one or more of the following:  1. Approved in-service LG experience 2. Approved LG Awareness Course	Aware of the various hazards on vessels containing LG cargoes
	<b><i>Safety equipment and protection of personnel</i></b>		
Carriage of LG cargoes	<b>3.</b> Aware of the safety equipment and personal protective equipment;  .1 specialized fire-extinguishing appliances; .2 breathing apparatus; .3 protective clothing and equipment; .4 rescue and escape equipment; .5 non sparking tools .6 electrical safety	Examination and assessment of evidence obtained from one or more of the following:  1. Approved in-service LG experience 2. Approved LG Awareness Course	Aware of the safety and personal protective equipment aboard LG tankers

	<b><i>Pollution prevention</i></b>		
Carriage of LG cargoes.	<b>4.</b> Aware of the types of pollution and its prevention;  .1 immediately report all relevant information to the appropriate shipboard official when a spill is detected.	Examination and assessment of evidence obtained from one or more of the following:  1. Approved in-service LG experience 2. Approved LG Awareness Course	Aware of the actions to be taken to report a spill.
	<b><i>Shipboard safety practices and equipment</i></b>		
Observe safe working practices.	<b>5.</b> Aware of adhering to safe working practices.	Examination and assessment of evidence obtained from one or more of the following:  1. Approved in-service LG experience 2. Approved LG Awareness Course	Aware that personal safety is safeguarded at all times for personnel.  Aware Safe working practices are observed and appropriate safety and protective equipment is correctly used at all times.
	<b><i>Emergency procedures</i></b>		
Respond to LG carrier emergencies.	<b>6.</b> Aware of LG ship emergency plans, procedures and duties.	Examination and assessment of evidence obtained from one or more of the following:  1. Approved in-service LG experience 2. Approved LG Awareness Course	Aware of response actions are in accordance with established plans and are appropriate to the urgency of the situation and nature of the emergency.

# **Liquefied Gas Mariner Training Standards**

## **LG TRAINING STANDARDS FOR PERSONS WITH SPECIFIC CARGO HANDLING DUTIES, OTHER THAN PERSON IN CHARGE**

### **LIQUEFIED GAS (LG) SPECIFIC DUTIES TRAINING PROGRAM - Paragraph 1 of Regulation V/1**

**Mandatory minimum requirements for the training and qualifications of masters, officers and able seafarers on LG tankers**

Chapter V

Section A-V/1

Mandatory minimum requirements for the training and qualification of masters, officers and able seafarers on LG tankers.

2. Officers and able seafarers assigned specific duties and responsibilities related to cargo or cargo equipment on LG tankers shall have completed an approved shore-based fire-fighting course in addition to the training required by regulation VI/1 and shall have completed, in addition to meeting the requirements of sub-paragraphs 1.1 have:
  - .1 at least three months seagoing service on LG tankers and an approved on board training program addressing the standards of competence in Section A-V/1 of the STCW-Code; or
  - .2 an approved LG tanker familiarization course addressing the standards of competence in Section A-V/1 of the STCW-Code.

***Referenced from: STCW Liquefied Gas Tanker Training Program/Section A-V/1, paragraphs 2 to 7 (plus 1 and 8 to 12)***



Column 1	Column 2	Column 3	Column 4
SPECIFIC DUTIES			
Competence	Knowledge, understanding, and proficiency	Methods for determining competence	Criteria for evaluating competence
	<b><i>Nomenclature of LG cargoes and Ship Terminology</i></b>		
Carriage of LG cargoes.	<b>1.</b> Be familiar with cargo terminology, covering ship type, ship operations, cargo terms, piping, and valves.	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	Familiar with the terms associated with LG cargoes and vessels.
	<b><i>Characteristics of LG cargoes</i></b>		
Carriage of LG cargoes.	<b>2.</b> Be familiar with basic chemistry and physics as it relates to the safe carriage of liquefied gases in bulk in ships, covering;  <ol style="list-style-type: none"> <li>.1 the properties and characteristics of liquefied gases and their vapors;</li> <li>.2 the properties of single liquids; and</li> <li>.3 the nature and properties of solutions.</li> </ol> Be familiar with relevant international conventions and relevant IMO, national, and industry codes.	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly identifies the property and characteristics of LG and other relevant gases and determines their impact on safety and vessel operations.</p> <p>Correctly identifies and uses information resources related to the property and characteristics of LG and other relevant gases.</p> <p>Legislative requirements related to relevant codes, practices are correctly identified.</p>

	<b><i>Personal Hazards and Toxicity of LG and Relevant Gases</i></b>		
Carriage of LG cargoes.	<p><b>3.</b> Familiar with a simple explanation of principles and basic concepts.</p> <p>.1 toxicity, including the modes by which liquefied gases and their vapors may be toxic; the toxic properties of inhibitors and of products of combustion of both materials of construction and of liquefied gases carried; acute and chronic effects of toxicity, systemic poisons and irritants; and the Threshold Limit Value (TLV);</p> <p>.2 the dangers to personnel covering hazards of skin contact, inhalation and ingestion;</p> <p>.3 medical first aid for LG emergencies.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly identifies the toxic/physical hazards of LG and other relevant gases and is aware of the impact on safety and personnel.</p> <p>Correctly identifies and follows proper procedures related to hazardous situations.</p>
	<b><i>Environmental and Cargo Hazards of LG and Relevant Gases</i></b>		
Carriage of LG cargoes.	<p><b>4.</b> Be familiar with hazards including:</p> <p>.1 flammability hazards, flammability limits and sources of ignition;</p> <p>.2 environmental hazards, covering: the effect on marine life from the release of liquefied gases or vapor; effect of specific gravity and solubility; danger from vapor cloud drift; effect of vapor pressure and atmospheric conditions;</p> <p>.3 reactivity hazards; effects of temperature; reaction with air, water and other chemicals; and</p> <p>.4 cryogenic hazards, covering brittle fracture and overpressure.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly identifies LG and other relevant gas hazards to the vessel and to the marine environment.</p> <p>Correctly identifies and follows proper procedures related to hazardous situations.</p> <p>Personal safety is safeguarded at all times for personnel.</p>

	<b><i>Hazard Control</i></b>		
Carriage of LG cargoes.	<b>5.</b> Familiarization with inerting, aerating, purging, gas freeing, hull protection, leak detection and mitigation, gas detection, ventilation, segregation and separation, and the importance of compatibility of materials.	Examination and assessment of evidence obtained from one or more of the following: <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly identifies LG and other relevant gas hazard controls to the vessel and to personnel.</p> <p>Correctly identifies and follows proper procedures related to hazardous situations.</p> <p>Personal safety is safeguarded at all times for personnel.</p>
	<b><i>Safety equipment and protection of personnel</i></b>		
Carriage of LG cargoes.	<b>6.</b> Familiarity with the function and calibration of measuring instruments and similar equipment; specialized fire-extinguishing appliances; breathing apparatus and LG tanker evacuating equipment; safe and proper use of protective clothing and equipment; use of resuscitators and other rescue and escape equipment. Familiar with certified safe electrical equipment and sources of ignition. Familiar with enclosed space entry procedures.	Examination and assessment of evidence obtained from one or more of the following: <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly identifies the safety equipment available.</p> <p>Correctly determine the proper equipment to use in various situations.</p> <p>Correctly adheres to the proper use of the safety equipment.</p>

	<b><i>Pollution prevention</i></b>		
Carriage of LG cargoes.	<p><b>7.</b> Familiarization with the procedures to be followed to prevent pollution and measures to be taken in the event of spillage, including the need to:</p> <p>.1 immediately report all relevant information to the appropriate shipboard official when a spill is detected or when a malfunction has occurred which poses a risk of a spill; and</p> <p>.2 properly implement shipboard spill-containment procedures.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	Correctly identifies appropriate actions to prevent, mitigate or respond to a pollution incident.
	<b><i>Cargo-handling systems</i></b>		
Monitor liquefied gas cargo operations.	<p><b>8.</b> Familiar with the main piping systems, valves, gauging/instruments and components of LG systems, gas detection and monitoring systems.</p> <p>Familiar with the fundamental principles of LG ship cargo containment systems.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	Correctly identify major types of containment systems, instruments and components of the LG piping system including liquid, vapor, cool down, inert gas, and nitrogen.
	<b><i>General principles of ship operating procedures</i></b>		
Monitor liquefied gas cargo operations.	<p><b>9.</b> Familiar with the entire LG cargo cycle.</p> <p>Clear and effective communication procedures on board the vessel and ship-to-shore.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Name and correctly identify the various stages of the LG cargo cycle.</p> <p>Communications are clear and understood utilizing proper shipboard terminology for LG cargo operations.</p>

	<b><i>Cargo safety practices and equipment</i></b>		
Observe safe working practices.	<p><b>10.</b> Importance of adhering to safe working practices at all times with special emphasis for LG specific equipment.</p> <p>Familiar with portable and fixed detectors, personal monitors, emergency shutdown (ESD) system, water spray curtain, hull-protection system and personnel wash stations.</p> <p>Familiar with LG fire extinguishing equipment, techniques and tactics.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Safe working practices are observed and appropriate safety and protective equipment is correctly used at all times.</p> <p>Working practices are in accordance with legislative requirements, codes of practice, permits to work, and environmental concerns.</p> <p>Fire fighting equipment is properly identified and located. Fire fighting techniques and tactics are followed.</p>
	<b><i>Emergency procedures</i></b>		
Respond to LG carrier emergencies.	<p><b>11.</b> Familiar with LG ship emergency plans, procedures and duties.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Response actions are in accordance with established plans and are appropriate to the urgency of the situation and nature of the emergency.</p>
	<b><i>LG Engineering Systems</i></b>		
Monitor LG Engineering Systems	<p><b>12.</b> Familiar with the propulsion types, gas combustions systems and high voltage systems on gas carriers.</p> <p>Familiar with the different types of gas combustion systems, pre-conditions for gas burning, the purging and starting sequence, pre- and post-gas burning purge and venting sequences, procedures to supply vapor to the machinery and maintenance and testing requirements of gas combustion.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly identifies the principal features and operating parameters of different propulsion types on LG carriers and turbo generators.</p> <p>Correctly identifies the gas combustion system and gas combustion procedures on LG carriers.</p> <p>Correctly identifies non-standard operating conditions.</p>

# **Liquefied Gas Mariner Training Standards**

## **LG STANDARDS FOR PERSONS IN CHARGE**

### **LIQUEFIED GAS (LG) PERSON IN CHARGE (PIC) TRAINING PROGRAM -**

#### **Paragraph 2 of Regulation V/1**

**Mandatory minimum requirements for the training and qualifications of masters, and officers on LG tankers**

Chapter V

Section A-V/1

Specialized training requirements for personnel on certain types of ships

3. Masters, chief engineers officers, chief mates, second engineer officers and any person with immediate responsibility for loading, discharging and care in transit or handling of cargo shall, in addition to meeting the requirements of sub-paragraphs 1.1, 2.1 and 2.2 have:
  - .1 experience appropriate to their duties on the type of LG tanker on which they serve;  
and
  - .2 completed an approved specialized LG training program which addresses the standards of competence in Section A-V/1 of the STCW Code.

***Referenced from: STCW Liquefied Gas Tanker Training Program/Section A-V/1, paragraphs 23 to 33 (plus 12 and 13).***

Column 1	Column 2	Column 3	Column 4
PERSON IN CHARGE			
Competence	Knowledge, understanding, and proficiency	Methods for determining competence	Criteria for evaluating competence
	<b><i>Regulations and codes of practice</i></b>		
Monitor and control compliance with relevant legislative requirements.	1. (23) Knowledge and understanding of relevant international conventions and relevant IMO, national and industry codes including record keeping requirements.	Examination and assessment of evidence obtained from one or more of the following: <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly cites how cargo and ballast operations are carried out in accordance with legislative requirements and industry codes.</p> <p>Correctly explains how established safety rules/regulations, equipment operating instructions and shipboard stowage limitations in compliance with stability requirements are adhered to.</p> <p>Potential non-compliance is promptly and fully identified.</p> <p>Correctly describes how information on dangerous, hazardous and special requirements is recorded in a format suitable for easy reference in the event of an incident.</p>
	<b><i>Regulations and codes of practice</i></b>		
Monitor and control compliance with relevant legislative requirements.	2. (24) Knowledge of the ship design and equipment of liquefied gas tankers; types of liquefied gas tankers; cargo-containment and insulation systems (construction, surveys); cargo-handling equipment (pumps, piping systems, and valves); cargo conditioning systems (warm-up, cool-down); tank atmosphere control systems (inert gas, nitrogen, and aeration); instrumentation of cargo-containment and handling systems; fire-fighting systems and safety and rescue equipment.	Examination and assessment of evidence obtained from one or more of the following: <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	Legislative requirements related to relevant codes, practices are correctly identified.

	<b><i>Fire Fighting</i></b>		
Prevent, control, and fight LG fire aboard ships.	<p><b>3.</b> (25) Understanding, application and integration of LG fire-fighting techniques and tactics applicable to gas tankers, including, but not limited to,</p> <ul style="list-style-type: none"> <li>.1 the use of water-spray systems;</li> <li>.2 dry chemical; and</li> <li>.3 high expansion foam.</li> </ul> <p>Must have completed training as specified in Regulation VI/3 – Advanced Fire Fighting of the STCW Code.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ul style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ul> <p>Assessment of evidence obtained from approved training set out in Section A VI/3.</p>	<p>The type and scale of the problem is promptly and accurately assessed and actions taken conform to emergency procedures and contingency plans for the ship.</p> <p>Evacuation, emergency shutdown and isolation procedures are appropriate to the nature of the emergency and are implemented promptly.</p> <p>Correctly establishes the order of priority, and the levels and time-scales of making reports and informing personnel on board, are relevant to the nature of the emergency and reflect the urgency of the situation.</p> <p>Personal safety during fire control activities is safeguarded at all times for personnel.</p>



	<b><i>Chemistry and physics</i></b>		
Carriage of LG cargoes.	<p><b>4.</b> (26) Understanding of basic chemistry and physics as it relates to the safe carriage of liquefied gases in bulk in ships, covering;</p> <p>.1 the properties and characteristics of liquefied gases and their vapors, including the definition of gas; simple gas laws; the gas equation; density of gases; diffusion and mixing of gases; compression of gases; liquefaction of gases; refrigeration of gases; critical temperature; the practical significance of flashpoint; upper and lower explosive limits; auto-ignition temperature; compatibility of gases; reactivity; polymerization and inhibitors;</p> <p>.2 the properties of single liquids, including densities of liquids and vapors; variation with temperature; vapor pressure and temperature; enthalpy; vaporization and boiling liquids; and</p> <p>.3 the nature and properties of solutions, including the solubility of gases in liquids; miscibility between liquids and effects of temperature change; densities of solutions and dependence on temperature and concentration; effects of dissolved substances on melting and boiling points; hydrates, their formation and dispersion; hygroscopicity; drying of air and other gases; dew point and low-temperature effects.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly explains the property and characteristics of LG and other relevant gases and determines their impact on safety and vessel operations.</p> <p>Correctly summarizes information resources related to the property and characteristics of LG and other relevant gases.</p>

	<b>Health hazards</b>		
Carriage of LG cargoes.	<p><b>5.</b> (27) Understanding of health hazards relevant to the carriage of liquefied gas and other relevant gases, covering;</p> <p>.1 toxicity, including the modes by which liquefied gases and their vapors may be toxic; the toxic properties of inhibitors and of products of combustion of both materials of construction and of liquefied gases carried; acute and chronic effects of toxicity, systemic poisons and irritants; and the Threshold Limit Value (TLV);</p> <p>.2 hazards of skin contact, inhalation and ingestion;</p> <p>.3 medical first aid and administering of antidotes.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly explains the health hazards of LG and other relevant gases and determines their impact on safety and personnel.</p> <p>Correctly explains proper procedures related to hazardous situations.</p> <p>Correctly explains the action to be taken in event of personnel contact with LG cargo.</p>
	<b>Cargo containment</b>		
Carriage of LG cargoes.	<p><b>6.</b> (28) Understanding of the principles of containment systems; rules; surveys; tank construction; materials coatings; insulation and compatibility, and the integration each serves in the design of an LG vessel.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly explains advantages and limitations of the liquid gas cargo containment construction design and materials.</p> <p>Correctly explains safe operating limits related to the specific cargo containment systems.</p>

	<b><i>Pollution</i></b>		
Monitor and control compliance with legislative requirements and measures to ensure the safety of life at sea and the protection of the marine environment.	<p><b>7.</b> (29) Understanding of the hazards to human life and to the marine environment; the effect of specific gravity and solubility; danger from vapor cloud drift and the jettisoning of LG cargo.</p> <p>Understanding of the precaution to prevent pollution and to protect the environment, vessel and personnel.</p> <p>Understanding of anti-pollution procedures and associated equipment, if applicable.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly explains LG hazards to human life and to the marine environment.</p> <p>Correctly explains the safe operating limits related to the pollution prevention equipment.</p>
	<b><i>Cargo-handling systems</i></b>		
Monitor and control of liquefied gas cargo loading, unloading and/or transfer operations and cargo care during the voyage.	<p><b>8.</b> (30) Understanding of the main types of cargo handling systems, <b>including:</b></p> <p>Air and Inert Gas Driers, Inert Gas Generator, Nitrogen Systems, LNG Vaporizer, High Duty Compressor(s), Low Duty Compressor(s), Gas Heaters, Forcing Vaporizer, Cargo Pumps, Spray Pumps, Cargo Tank Protection Devices *, Cargo Line Protection Devices, Cargo Space Protection Devices, Cargo Liquid and Vapor Valves, Cargo tank protection system, Reliquefaction plant, Gas Combustion Unit (Oxidizer), Re-gasification plant, Cargo related spaces, Nitrogen Pressurization and Purge, Cofferdam Heating System, Emergency Shutdown System *. Emergency Mooring Release, Water Curtain, Drenching System, Fixed dry powder installations,</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly explains limitations and operating conditions related to the cargo handling systems.</p>

	Level Gauging Systems, Custody Transfer System (CTS), IAS system		
	<b>General principles of ship operating procedures</b>		
Monitor and control liquid cargo loading, unloading, transfer operations, ballast operations and control trim, stability, and stress.	<p><b>9.</b> (31) Understanding and application of loading and discharging preparations and procedures; checklists; cargo condition maintenance on passage and in harbor; segregation of cargoes and procedures for cargo transfer; changing cargoes, tank cleaning procedures; cargo sampling; ballasting and de-ballasting; warm-up and gas-freeing procedures; and procedures for cool down of a gas-free system from ambient temperature and the safety precautions involved.*</p> <p>Understand the fundamental principles of ship construction and the theories and, factors affecting trim and stability and measures necessary to preserve trim and stability.</p> <p>Understand the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken.</p> <p><b>The above shall include:</b> Cargo Tank Cleaning, Hold Space and Cargo Tank Drying, Nitrogen Purging of Containment System, Inerting of Cargo System, Ship and Shore Preparation and Manifold Connection *, Gassing Up (Purging) of Cargo System, Cool Down of Cargo System, Loading, Loaded</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Cargo and ballast operations are carried out in accordance with the cargo plan or other documents and established safety rules/regulations, equipment operating instructions and shipboard stowage limitations.</p> <p>Trim, stability, and stress conditions are maintained within safe limits at all times.</p> <p>Potential non-compliance is promptly and fully identified.</p> <p>Action taken and procedures followed correctly apply and make full use of appropriate shipboard equipment.</p> <p>Procedures for monitoring and safety systems ensure that all alarms are detected promptly and acted upon in accordance with established emergency procedures.</p> <p>Communications are clear and understood utilizing properly shipboard terminology for LG cargo operations.</p>

	and Ballast Passage, Discharging, Warm Up, Gas Freeing, Aeration.		
<b>* As Soon As Practical and Effective by No Later Than 2012 – Column 3 assessment of evidence obtained shall be from a combination of written <u>and</u> practical demonstration of critical ship operational procedures in the cycle from ambient to preparing to load and from tank stripping to aerating.</b>			
	<b><i>Safety practices and equipment</i></b>		
Observe safe working practices.	<p><b>10.</b> (32) Understanding importance of adhering to safe working practices at all times with special emphasis for LG specific equipment.</p> <p>Knowledge of international / industry measures concerning accident prevention and occupational health.</p> <p>Understanding and application of the function, calibration and use of gas detection instruments; fire fighting equipment and procedures; breathing apparatus; resuscitators; escape sets; rescue equipment; protective clothing and equipment; entry into enclosed spaces; precautions to be observed before and during repair and maintenance of cargo and control systems; supervision of personnel during potentially hazardous operations; types and principles of certified safe electrical equipment and sources of ignition.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol> <p>Practical demonstration of the calibration and operation of a gas detection device.</p>	<p>Correctly explains how safe working practices are observed and appropriate safety and protective equipment is correctly used at all times.</p> <p>Correctly identifies working practices that are in accordance with legislative requirements, codes of practice, permits to work, and environmental concerns.</p> <p>Correctly calibrates a gas detection device.</p>

	<b><i>Emergency procedures</i></b>		
Respond to LG carrier emergencies.	<p><b>11.</b> (33) Understanding the importance of developing ship emergency plans; emergency shutdown of cargo operations; emergency cargo valve closing systems; action to be taken in the event of failure of systems or services essential to cargo; and action to be taken following collision or stranding, spillage and envelopment of the ship in toxic or flammable vapor, <b>including:</b></p> <p>Multiple Cargo Pump Failure in One Tank, Gas Freeing Single Tank, Ship to Ship Transfer of Cargo *, Part Load and Discharge *, Key Equipment not Available, Loss of Gas Burning Capability, Prolonged Loss of Power to Cargo and Ancillary Systems, Loss of Primary Barrier, Ballast Tank Leakage into Containment Space, Nitrogen Supply Failure, Jettison of cargo, Overfilling of a Cargo Tank *, Loss of Cargo Pipeline Containment, Failure of Integrated Automation System, Uncontrolled Release of Cargo</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly explains how response actions are in accordance with established contingency plans and are appropriate to the urgency of the situation and nature of the emergency.</p>

	<b><i>LG Engineering Systems</i></b>		
Monitor LG Engineering Systems	<p><b>12.</b> Understanding of propulsion types, gas combustions systems and high voltage systems on gas carriers.</p> <p>Understands the different types of gas combustion systems, pre-conditions for gas burning, the purging and starting sequence, pre- and post-gas burning purge and venting sequences, procedures to supply vapor to the machinery and maintenance and testing requirements of gas combustion.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly explains the principal features and operating parameters of different propulsion types on LG carriers.</p> <p>Correctly explains the gas combustion system and gas combustion procedures on LG carriers.</p> <p>Correctly identifies non-standard operating conditions.</p>
	<b><i>Commercial Considerations</i></b>		
Awareness of Commercial Considerations	<p><b>13.</b> Knowledge and understanding of commercial aspects of the LNG trade in transportation.</p> <p>Knowledge and understanding of vetting and inspection processes.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <ol style="list-style-type: none"> <li>1. Approved in-service LG experience.</li> <li>2. Approved LG training ship experience.</li> <li>3. Approved LG simulator training.</li> <li>4. Approved LG training program.</li> </ol>	<p>Correctly identifies the principles of LG measurements, the basic types of charter parties, the basic time charter performance clauses, and the economic implication of boil-off heel management.</p> <p>Correctly explains the vetting and inspection process.</p>